

CLAIMS

1. Folding machine to fold a web material (N) along transverse folding lines, comprising at least one folding roller (1, 3; 505) provided with at least one gripping member (43; 513) to mechanically grasp the web material (N)

5 along a folding line;

characterized in that a gaseous flow member (79; 515; 601) is associated with said at least one gripping member (43; 513) to insert the web material into said gripping member (43; 513).

2. Machine according to claim 1, characterized in that said gaseous flow member is a suction member to draw the web material (N) towards said gripping member (43; 513).

3. Machine as claimed in claim 1 or 2, characterized in that it comprises two counter-rotating folding rollers (1, 3), with parallel axes, each of which is provided with at least one gripping member (43).

4. Folding machine as claimed in claim 2 or 3, characterized in that each of said suction members (79) is associated with a device to activate and deactivate suction as a function of the angular position of the respective folding roller (1, 3; 505), the suction member (79) of each folding roller (1, 3; 505) being active for a fraction of a complete turn of the respective folding roller.

5. Folding machine as claimed in one or more of claims 2 to 4, characterized in that said gripping member (43; 513) comprises a movable element (61) cooperating with a first stop (63C); the web material being sucked by said suction member (79; 515) between said movable element (61) and said stop (63C).

6. Folding machine as claimed in claim 5, characterized in that said movable element (61) cooperates with a second stop (73), said first and said second stop defining a slit essentially parallel to the axis of rotation (1A, 3A; 505A) of the respective folding roller, the movable element (61) extending in said slit.

7. Folding machine as claimed in one of more of the previous claims, characterized in that each of said folding rollers (1, 3) comprises at least a cavity (41) substantially parallel to its axis of rotation (1A, 3A) and open on the cylindrical surface of the folding roller, inside which the respective gripping member (43) is housed, and in that a suction duct (79) terminates in said cavity.

8. Folding machine as claimed in claim 5 and 7, characterized in that each of said cavities (41) are provided with means to limit the effect of suction on one side of the movable element (61), between it and said first stop (63C).

9. Folding machine as claimed in at least claims 5 and 7 or 5 and 8,
5 characterized in that a first block (63) defining said first stop (63C) is fixed in said cavity (41).

10. Folding machine as claimed in at least claims 6 and 7, characterized in that a second block (65) defining said second stop (73) is fixed in said cavity (41).

11. Folding machine as claimed in at least claim 9, characterized in that said first block (63) delimits a suction compartment (78) in connection with said suction duct (79) and is provided with a plurality of suction holes (63E) distributed along the longitudinal extension of said first block (63) and terminating on a surface of said block positioned on the opposite side with respect to said suction compartment (78) and facing the movable element (61).
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12. Folding machine as claimed in claim 11; characterized in that said movable element is supported by a shaft (45) oscillating around its longitudinal axis (45A), supported in said cavity (41), and in that said first block (63) has a sealing surface (63D) cooperating with said oscillating shaft (45), said holes (63) terminating between the first stop (63C) defined by said first block (63) and said sealing surface (63D).
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13. Folding machine as claimed in one of more of the previous claims, characterized in that each of said gripping members (43) includes an elastic strip (61).
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14. Folding machine as claimed in claim 12 and 13, characterized in that said elastic strip (61) is integral with said oscillating shaft (45) and cooperates with said first stop (63C).

15. Folding machine as claimed in one of more of the previous claims, characterized in that each of said folding rollers is associated with a sliding block (81) with a communication channel (105, 37) between a suction line (109) and a suction duct (79) in the respective folding roller, said sliding block resting on a sliding surface (1F, 3F) of the folding roller (1, 3).
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16. Folding machine as claimed in claim 15, characterized in that said sliding surface is disposed on a front surface of the respective folding roller (1,
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3) on which said suction duct (79) terminates.

17. Folding machine as claimed in claim 15 or 16, characterized in that said sliding block is resiliently pushed against said sliding surface (1F, 3F).

5 18. Folding machine as claimed in claim 15, 16 or 17, characterized in that said sliding block has an elongated aperture (105) communicating with the respective folding roller.

10 19. Folding machine as claimed in at least claim 4, characterized in that said devices to activate and deactivate suction are adjustable, to adjust the positions in which suction is opened and closed as a function of the angular position of the respective folding roller.

20. Folding machine as claimed in claim 15, 16, 17 or 18, characterized in that said sliding block (81) is disposed in a specific angular position adjustable with respect to the relative folding roller (1, 3).

15 21. Folding machine as claimed in claim 20, characterized in that said sliding block (81) is engaged with a flange (89) coaxial to the respective folding roller (1, 3), the angular position of which around the axis of the folding roller (1, 3) is adjustable.

20 22. Folding machine as claimed in one of more of the claims 1, 4-21, characterized in that a cutting unit (501, 503) that cuts the web material (N) into single sheets, which are folded by said folding roller, is associated with said folding roller (505).

25 23. Folding machine as claimed in claim 22; characterized in that said cutting unit has two counter-rotating cylinders (501, 503) with axes parallel to each other and to the folding roller, which define between them a nip through which the web material is fed, and provided with blades and counter-blades (509, 511) to cut the web material (N), and in that one of said two counter-rotating cylinders (501, 503) forming the cutting unit forms with the folding roller a nip through which the cut web material is fed.

30 24. Folding machine as claimed in one of more of the previous claims, characterized in that said at least one folding roller (1; 3; 505) cooperates with a counter-roller (3; 1; 503), on which a projection (201A) is provided extending parallel to the axis of said rollers, the position of said projection being synchronized with respect to the position of said gripping member, to facilitate pick-up of said web material (N) by suction.

25. Folding machine as claimed in claims 3 and 24, characterized in that a corresponding projection (201A) is provided on each of said folding rollers, each projection (201A) of one of said folding rollers (1, 3) cooperating with a gripping member of the opposite folding roller.

5 26. Folding machine as claimed in claim 1, characterized in that said gaseous flow member includes an air ejection member (601), to push the web material inside said gripping member (43).

10 27. Folding machine as claimed in claim 3 and 26, characterized in that on each folding roller an air ejection member (601) and a gripping member (43) are provided, arranged on diametrically opposed positions.

28. Folding machine as claimed in claim 26 or 27, characterized in that said gaseous flow member includes at least one air nozzle (601).

29. Folding machine as claimed in claim 28, characterized in that said nozzle is a linear nozzle extending parallel to the axis of the folding roller (1, 3).

15 30. A method for folding a web material according to transverse folding lines, comprising the phases of:

- providing at least one folding roller (1);
- providing, on said folding roller at least one gripping member (43);
- rotating said folding roller around its axis;
- feeding the web material to said folding roller;
- engaging the web material with said at least one gripping member of said folding roller;

characterized in that the web material is inserted into said gripping member by means of a gaseous flow.

25 31. Method as claimed in claim 30, characterized in that said web material is inserted into said gripping member by suction.

32. Method as claimed in claim 30, characterized in that said web material is inserted into said gripping member by means of an air jet.

30 33. Method as claimed in claim 30 or 31 or 32, characterized by providing two counter-rotating folding rollers with parallel axes, which define a nip through which the web material is fed, each of said folding rollers being provided with at least one gripping member, and in that the web material is engaged alternately with a gripping member (43) of the first folding roller (1) and with a gripping member of the second folding roller (3), to fold said web material

in a zigzag.

34. Method as claimed in one or more of claims 30 to 33, characterized by activating the gaseous flow associated with each of said gripping members in an angular position of the respective folding roller upstream of the nip (5) between the two folding rollers, and deactivating said gaseous flow after the web material has been engaged by the respective gripping member.

35. Method as claimed in claim 34, characterized in that said gaseous flow is deactivated when the respective gripping member has passed beyond the nip between said folding rollers.

10 36. Method as claimed in one or more of the claims 30 to 35, characterized by pinching the web material between a stop (63C), fixed with respect to the relative folding roller (1, 3), and a movable element (61).

37. Method as claimed in claim 36, characterized in that said gaseous flow is concentrated between the fixed stop and said movable element.

15 38. Method as claimed in one or more of the claims 30 to 37, characterized by facilitating the formation of a fold in said web material in front of said gripping member.

20 39. Method as claimed in claim 38, characterized in that folding is facilitated by a projection provided on a roller (3, 503) positioned opposite to said at least one first folding roller (1).

40. Method as claimed in claim 38 or 39, characterized in that said gripping member does not cooperate mechanically with said projection.